UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/892,332	06/26/2001	Ching-Wei Chang	TAL/7146.119	1906

7590 03/17/2008

Timothy A. Long
Chernoff, Vilhauer, McClung & Stenzel, LLP
1600 ODS Tower
601 S.W. Second Avenue
Portland, OR 97204-3157

EXAMINER	
THOMPSON, JAMES A	

ART UNIT	PAPER NUMBER
2625	

MAIL DATE	DELIVERY MODE
03/17/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/892,332	CHANG, CHING-WEI	
	Examiner	Art Unit	
	JAMES A. THOMPSON	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 December 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) _____ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-4 and 12-19* is/are allowed.

6)☒ Claim(s) *5-11 and 20-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 12 December 2007 have been fully considered but they are not persuasive.

Firstly, Ostromoukhov (USPN 6,356,362 B1) teaches error diffusion, which operates based upon accumulated error, specifically accumulated quantization error (see column 10, lines 18-23 of Ostromoukhov). Ostromoukhov also teaches selecting a first predetermined intensity threshold (figure 8(S804) of Ostromoukhov) if the difference (*gradient*) between the current pixel and a neighboring pixel is less than a threshold (figure 8(S803→S804) and column 10, lines 35-37 of Ostromoukhov) and otherwise selecting a second predetermined intensity threshold (figure 8(S803→S805) and column 10, lines 28-36 of Ostromoukhov). What Ostromoukhov teaches differs from the recited claim in that the first predetermined intensity threshold is selected based on a *difference* between the current pixel and a neighboring pixel, rather than being selected if either one of said current said accumulated pixel error and a neighboring said accumulated pixel error is less than an error threshold.

In Smith (USPN 5,633,729) the computed quantization errors determine which threshold from the threshold matrices is selected (figure 10 and column 10, lines 23-33 of Smith). Thus, by combination with Ostromoukhov, a predetermined intensity threshold is selected for a current pixel based on the accumulated level of quantization error of the image data when the current pixel is processed. By combining Smith with Ostromoukhov, the intensity threshold of a pixel is determined based on the level of quantization error, as taught by Smith, rather than the gradient, as taught by Ostromoukhov. Thus, in the context of the system of Ostromoukhov, the first predetermined intensity threshold is selected if either one of said current said accumulated pixel error and a neighboring said accumulated pixel error is less than an *error* threshold, rather than a gradient threshold.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 5-11, 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ostromoukhov (US Patent 6,356,362 B1) in view of Smith (US Patent 5,633,729).

Regarding claim 5: Ostromoukhov discloses a halftone image display method providing respective accumulated pixel errors, each based on at least one respective variance between a rendered intensity of a pixel and a quantized measured intensity of a corresponding pixel of a contone image to be displayed, each respective accumulated error subject to recalculation pixel-by-pixel (column 10, lines 48-64 of Ostromoukhov), said method comprising the steps of: (a) determining an intensity of a current pixel in an image (figure 8(S801) and column 10, lines 28-31 of Ostromoukhov); (b) augmenting said intensity of said current pixel with a current said accumulated pixel error (figure 8(S812) and column 10, lines 48-59 of Ostromoukhov – *intensity of current pixel determined and augmented according to normal error diffusion processing*); (c) selecting a first predetermined intensity threshold (figure 8(S804) of Ostromoukhov) if the difference (*gradient*) between the current pixel and a neighboring pixel is less than a threshold (figure 8(S803→S804) and column 10, lines 35-37 of Ostromoukhov) and otherwise selecting a second predetermined intensity threshold (figure 8(S803→S805) and column 10, lines 28-36 of Ostromoukhov); (d) rendering said current pixel with a first rendered intensity if said augmented intensity of said current pixel exceeds said selected predetermined intensity threshold and otherwise rendering said current pixel with a second rendered intensity (column 10, lines 38-47 of Ostromoukhov); and (e) assigning an error between said displayed intensity and said augmented intensity of said current pixel to at least one pixel neighboring said current pixel (column 10, lines 48-59 of Ostromoukhov).

While Ostromoukhov teaches that the current pixel is rendered by a printer, rather than displayed on a display, Ostromoukhov also discloses a display (figure 3(22) of Ostromoukhov) used to display images to a user (column 4, lines 54-56 of Ostromoukhov). Ostromoukhov also teaches that several changes may be applied to the disclosed system without departing from the teaching of the invention, and that the disclosed system is illustrative, rather than limiting (column 12, lines 13-18 of Ostromoukhov). Utilizing a display to display the image would clearly be a minor and obvious variation from the specifically disclosed system of Ostromoukhov, and would obtain predictable results over the disclosed rendering with a printer. Thus, displaying the image on a display would have been an obvious modification for one of ordinary skill in the art at the time of the invention to have made to the embodiment specifically disclosed by Ostromoukhov.

Ostromoukhov does not disclose expressly that said first predetermined intensity threshold is selected if either one of said current said accumulated pixel error and a neighboring said accumulated pixel error is less than an error threshold.

Smith discloses selecting a predetermined intensity threshold for a current pixel based on the accumulated level of quantization error of the image data when the current pixel is processed (figure 10 and column 10, lines 23-33 of Smith – *computed quantization errors determine which threshold from the threshold matrices is selected*).

Ostromoukhov and Smith are analogous art since they are from the same field of endeavor, namely the rendering and output of digital image data *via* the use of threshold selection based on image data properties. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to determine the intensity threshold of a pixel based on the level of quantization error, as taught by Smith, rather than the gradient, as taught by Ostromoukhov. Thus, in the context of the system of Ostromoukhov, the first predetermined intensity threshold is selected if either one of said current said accumulated pixel error and a neighboring said accumulated pixel error is less than an *error* threshold, rather than a gradient threshold. The motivation for doing so would have been to minimize the overall quantization error, thus providing a more consistent output (column 6, lines 15-24 of Smith). Therefore, it would have been obvious to combine Smith with Ostromoukhov to obtain the invention as specified in claim 5.

Further regarding claim 6: Smith discloses that said error threshold is substantially zero (column 8, lines 59-65 of Smith). Since the quantization error is desired to be minimized (column 8, lines 59-65 of Smith), then the error threshold will be substantially zero.

Regarding claim 7: Ostromoukhov discloses that said first displayed intensity comprises a maximum intensity (white) and said second displayed intensity comprises a minimum intensity (black) (column 10, lines 38-47 of Ostromoukhov).

Further regarding claim 8: Smith discloses that said intensity of said current pixel comprises an intensity of a color component of said pixel (column 2, lines 54-59 of Smith).

Further regarding claim 9: Smith discloses that an intensity of said first intensity threshold is greater than an intensity of said second intensity threshold (column 9, lines 45-60 of Smith). The intensity thresholds are sorted in ascending according to error value (column 9, lines 45-60 of Smith). Thus, for large input values, the intensity of said first intensity threshold will be greater than an intensity of said second intensity threshold.

Further regarding claim 10: Smith discloses the step of displaying said current pixel with said first displayed intensity if said augmented intensity of said current pixel exceeds a third intensity threshold (Ly), an intensity of said third intensity threshold being greater than an intensity of said first threshold intensity threshold (0) (column 9, lines 50-58 of Smith).

Further regarding claim 11: Smith discloses that at least one of said current said accumulated pixel error and said neighboring accumulated pixel error comprises a component color error (column 2, lines 54-59 of Smith).

Regarding claim 20: Ostromoukhov discloses a halftone encoder residing on an electronic device (figure 4; column 4, lines 48-50; and column 5, lines 24-28 of Ostromoukhov) and providing respective accumulated errors, each based on at least one respective variance between a rendered intensity of a pixel and a quantized measured intensity of a corresponding pixel of a contone image to be displayed, each respective accumulated error subject to recalculation pixel-by-pixel (column 10, lines 48-64 of Ostromoukhov), said encoder comprising: (a) a selected thresholding unit (column 5, lines 13-18 of Ostromoukhov – *selected thresholding unit is corresponding portion of embodied software*) comparing an input intensity of a current pixel to a selected threshold intensity (figure 3(S803-S809) and column 10, lines 30-47 of Ostromoukhov); and (b) a threshold selection unit (column 5, lines 13-18 of Ostromoukhov – *threshold selection unit is corresponding portion of embodied software*) selecting one of a plurality of predetermined threshold intensities for said selected threshold unit in response to the difference (*gradient*) between the current pixel and a pixel neighboring said current pixel (figure 8(S803-S805) and column 10, lines 28-37 of Ostromoukhov).

Ostromoukhov does not disclose expressly that said threshold is selected in response to at least one of said accumulated errors of said current pixel and a pixel neighboring said current pixel.

Smith discloses selecting a predetermined intensity threshold for a current pixel in response to the accumulated level of quantization error of the image data when the current pixel is processed (figure 10 and column 10, lines 23-33 of Smith – *computed quantization errors determine which threshold from the threshold matrices is selected*).

Ostromoukhov and Smith are analogous art since they are from the same field of endeavor, namely the rendering and output of digital image data *via* the use of threshold selection based on image data properties. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to determine the intensity threshold of a pixel based on the level of quantization error, as taught by Smith, rather than the gradient, as taught by Ostromoukhov. Thus, in the context of the system of Ostromoukhov, said threshold is selected in response to at least one of said accumulated *errors* of said current pixel and a pixel neighboring said current pixel, rather than the *gradient*. The motivation for doing so would have been to minimize the overall quantization error, thus providing a more consistent output (column 6, lines 15-24 of Smith). Therefore, it would have been obvious to combine Smith with Ostromoukhov to obtain the invention as specified in claim 20.

Regarding claim 22: Ostromoukhov discloses (a) an error filter distributing an error produced by printing said current pixel to a plurality of pixels neighboring said current pixel (column 9, lines 36-38 of Ostromoukhov); and (b) an error buffer accumulating said distributed error for a pixel (column 9, lines 48-56 of Ostromoukhov).

4. Claims 5-11, 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ostromoukhov (US Patent 6,356,362 B1) in view of Smith (US Patent 5,633,729) and Zlotnick (US Patent 6,351,566 B1).

Regarding claim 21: Ostromoukhov in view of Smith does not disclose expressly an initial thresholding unit comparing said input intensity of said current pixel to an initial threshold intensity, said initial threshold being greater than said selected threshold intensity.

Zlotnick discloses an initial thresholding unit (figure 4 (44) of Zlotnick) for comparing said input intensity of said current pixel to an initial threshold intensity (T+D/2) (figure 5(54) and column 8, lines 5-11 of Zlotnick). Since D is clearly a positive number (column 8, lines 5-11 of Zlotnick), said initial threshold intensity (T+D/2) is greater than one of the possible selected intensity thresholds (T). Since the other possibly selected intensity threshold (figure 6("AVERAGE") of Zlotnick) is for use with intermediate values (column 8, lines 8-14 of Zlotnick), said other intensity threshold is less than (T). Therefore, said initial intensity threshold is greater than said selected threshold intensity.

Ostromoukhov in view of Smith is analogous art with respect to Zlotnick because they are from similar problem solving areas, namely selectively halftoning digital image data for various pixel values. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the initial thresholding unit taught by Zlotnick before the threshold selection unit. The motivation for doing so would have been to be able to determine initially which category the input image pixel falls into (column 8, lines 8-14 of Zlotnick). Thus, including the initial thresholding unit of Zlotnick into the system taught by Ostromoukhov in view of Smith would improve the overall image data processing and increase processing efficiency and accuracy by clearly setting forth in advance how the input pixels are to be processed. Therefore, it would have been obvious to combine Zlotnick with Ostromoukhov in view of Smith to obtain the invention as specified in claim 21.

Allowable Subject Matter

5. Claims 1-4 and 12-19 are allowed.

The following is an examiner's statement of reasons for allowance:

Independent claim 1 recites a method whereby one of three possible thresholds is selected for use in halftone rendering. The criterion behind the threshold selection is the comparison of the level of error, which is accumulated *via* standard error diffusion, with two different error thresholds. If the accumulated error for both the current pixel and a neighboring pixel are greater than a first error threshold, then the first predetermined intensity threshold is selected. If, however, this condition is not met, a second comparison is performed which compares the accumulated error of a remotely neighboring pixel and a second error threshold. If the accumulated error of the remotely neighboring pixel is greater than the second error threshold, then the second predetermined intensity threshold is selected. If neither the first or second intensity threshold is selected, a third predetermined intensity threshold is selected by default. The selected threshold is then used to render and output the pixel.

Examiner has not discovered this particular and specific form of threshold selection in the prior art, nor has Examiner found a combination of references which would render this particular method obvious to one of ordinary skill in the art at the time of the invention. Accordingly, independent claim 1 is deemed allowable over the prior art. Claims 2-4 are deemed allowable at least owing to their dependencies from claim 1.

Independent claim 12 recites a method whereby one of four possible thresholds is selected for use in halftone rendering. The criterion behind the threshold selection is the comparison of the level of error, which is accumulated *via* standard error diffusion, with three different error thresholds. If the accumulated error for either one of the current pixel or a neighboring pixel is less than a first error threshold, then the first predetermined intensity threshold is selected. If, however, this condition is not met, a second comparison is performed which compares the accumulated error of a remotely neighboring pixel and a second error threshold. If the accumulated error of the remotely neighboring pixel is less than the second error threshold, then the second predetermined intensity threshold is selected. If neither the first or second intensity threshold is selected, a third comparison is performed which compares the accumulated error of a more remotely neighboring pixel with a third error threshold. If the accumulated error of the more remotely neighboring pixel is less than the third error threshold, then the third predetermined intensity threshold is selected. If neither the first, second or third intensity thresholds are

selected, then a fourth predetermined intensity threshold is selected by default. The selected threshold is then used to render and output the pixel.

Examiner has not discovered this particular and specific form of threshold selection in the prior art, nor has Examiner found a combination of references which would render this particular method obvious to one of ordinary skill in the art at the time of the invention. Accordingly, independent claim 12 is deemed allowable over the prior art. Claims 13-19 are deemed allowable at least owing to their dependencies from claim 12.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

6. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is (571)272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward L. Coles can be reached on 571-272-7402. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edward L. Coles/
Supervisory Patent Examiner, Art Unit 2625

/J. A. T./
James A. Thompson
Examiner, Art Unit 2625

04 March 2008